CLAIMS

We claim:

1. A cardiac pacing apparatus, for artificially stimulating contractions in a heart of an animal, comprising:

a power transmitter which periodically transmits a pulse of a radio frequency signal;

a first electrode and a second electrode for implantation in the animal; and

a vascular electrode-stent for implantation in a blood vessel of the animal and comprising a pickup device for receiving the radio frequency signal and a cardiac signal emitted from a sinus node of the heart, and a pacing signal circuit connected to the pickup device and having an electrical storage device, wherein the pacing signal circuit charges the electrical storage device with electrical energy from the radio frequency signal and in response to detecting the cardiac signal applies a stimulation voltage pulse across the first electrode and the second electrode to cause a contraction of the heart.

2. The apparatus as recited in claim 1 wherein the first electrode is mounted on the vascular electrode-stent.

3. The apparatus as recited in claim 1 wherein the electrical storage device is a capacitor.

4. The apparatus as recited in claim 1 wherein the pickup device comprises a coil.

5. The apparatus as recited in claim 1 wherein the pacing signal circuit comprises:

a discriminator connected to the pickup device, and charging the electrical storage device in response to detecting a pulse of the radio frequency signal, and producing a trigger signal in response to detecting the cardiac signal; and

a pulse circuit connected to the discriminator and the electrical storage device, and applying the stimulation voltage pulse across the first electrode and the second electrode in response to the trigger signal.

6. The apparatus as recited in claim 5 wherein the discriminator distinguishes between the radio frequency signal from the power transmitter and the cardiac signal emitted from the sinus node based on differences in their signal waveforms.

7. The apparatus as recited in claim 6 wherein each pulse of the radio frequency signal from the power transmitter has a leading edge which is longer in duration than a leading edge of the cardiac signal emitted from the sinus node.

8. The apparatus as recited in claim 1 wherein the pulses of the radio frequency signal from the power transmitter and pulses of the cardiac signal emitted from the sinus node are asynchronous.

9. The apparatus as recited in claim 1 further comprising a third electrode for implantation in the animal and connected to the vascular electrode-stent, wherein the pacing signal circuit applies a voltage pulse to the third electrode.

10. A cardiac pacing apparatus, for artificially stimulating contractions in a heart of an animal, comprising:

a power transmitter which periodically transmits a pulse of a radio frequency signal;

a vascular electrode-stent for implantation in a blood vessel of the animal and comprising a body, a pacing signal circuit on the body, a pickup coil for receiving the radio frequency signal and a cardiac signal emitted from a sinus node of the heart, and a first electrode mounted to the body; and

a second electrode for implantation in a blood vessel of the animal;

the pacing signal circuit comprises an electrical storage device, a discriminator connected to the pickup coil and charging the electrical storage device in response to detecting a pulse of the radio frequency signal and producing a trigger signal in response to detecting the cardiac signal, and a pulse circuit connected to the discriminator and the electrical storage device and applying a stimulation voltage pulse across the first electrode and the second electrode to cause a contraction of the heart.

11. The apparatus as recited in claim 10 wherein the body is expandable within the blood vessel from a first cross-sectional size to a second cross-sectional size.

12. The apparatus as recited in claim 10 wherein the first electrode is a conductive ring that encircles the body of the vascular electrode-stent.

13. The apparatus as recited in claim 10 wherein the electrical storage device is a capacitor.

14. The apparatus as recited in claim 10 wherein the discriminator distinguishes between the radio frequency signal from the power transmitter and the cardiac signal emitted from the sinus node based on differences in their signal waveforms.

15. The apparatus as recited in claim 14 wherein each pulse of the radio frequency signal from the power transmitter has a leading edge which is longer in duration than a leading edge of the cardiac signal emitted from the sinus node.

16. The apparatus as recited in claim 10 wherein the pulses of the radio frequency signal from the power transmitter and pulses of the cardiac signal emitted from the sinus node are asynchronous.

17. The apparatus as recited in claim 10 further comprising a third electrode for implantation into a blood vessel of the animal and connected to the pacing signal circuit, wherein the pulse circuit applies a voltage pulse between the first and third electrodes.

18. The apparatus as recited in claim 10 further comprising a third electrode for implantation into a blood vessel of the animal and connected to the vascular electrode-stent, wherein the pacing signal circuit applies a voltage pulse between the second and third electrodes.

19. A method for stimulating contractions of a heart of an animal, the method comprising:

implanting a vascular electrode-stent into a blood vessel at a first location in the animal, the vascular electrode-stent having an pickup device and a first electrode both of which are connected to a pacing signal circuit that has an electrical storage device;

implanting a second electrode into a blood vessel at a second location in the animal, wherein the second electrode is connected to the pacing signal circuit of the vascular electrode-stent;

transmitting a radio frequency signal to the vascular electrode-stent;

charging the electrical storage device with electrical energy received by the pacing signal circuit from the radio frequency signal;

the pacing signal circuit detecting emission of a cardiac signal from a sinus node of the heart; and

the pacing signal circuit responding to detecting emission of the cardiac signal by applying voltage, from the electrical storage device, across the first and second electrodes to stimulate contraction of the heart.